Rockwell Automation Application Content

Device Libraries

Reference Manual

Power Discrete – Device Object Library

raC_Dvc_AS291E	**V2.2**
raC_Dvc_AS281E	**V2.2**

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://literature.rockwellautomation.com) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances or death, property damage, or economic loss. Attentions avoid a hazard, and recognize the consequence.
SHOCK HAZARD	Labels may be on or inside the equipment, that dangerous voltage may be present.
BURN HAZARD	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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1. Overview

This document includes the functional requirements of the ArmorStart 291E and 281E Power Discrete Device Objects

These Preconfigured Power Discrete Device Objects include an Add-On Instruction Rung and an HMI Faceplate providing:

- Detailed Device Data Collection and Delivery
- Enhanced Device Status and Diagnostics
- Common Control Interfaces maximizing Flexible Automation Device Selection & Application Code Reuse

Device Object Use Cases:

- Basic Device Maintenance and Diagnostics
- Virtual Device Operations for Startup and Commissioning
- Operator and Program Control for Discrete Machine and Process Applications

1.1 Prerequisites

1.1.1 Required Software

- Studio5000 Logix Designer v31.00.00 and later for PAC Application Development
- Studio5000 View Designer v4.01 and later for PanelView 5000 Application Development
- FactoryTalk View Studio v10 and later for PanelView Plus Application Development

1.1.2 Required Hardware

At minimum, you will need the following hardware in order to run or test these faceplates:

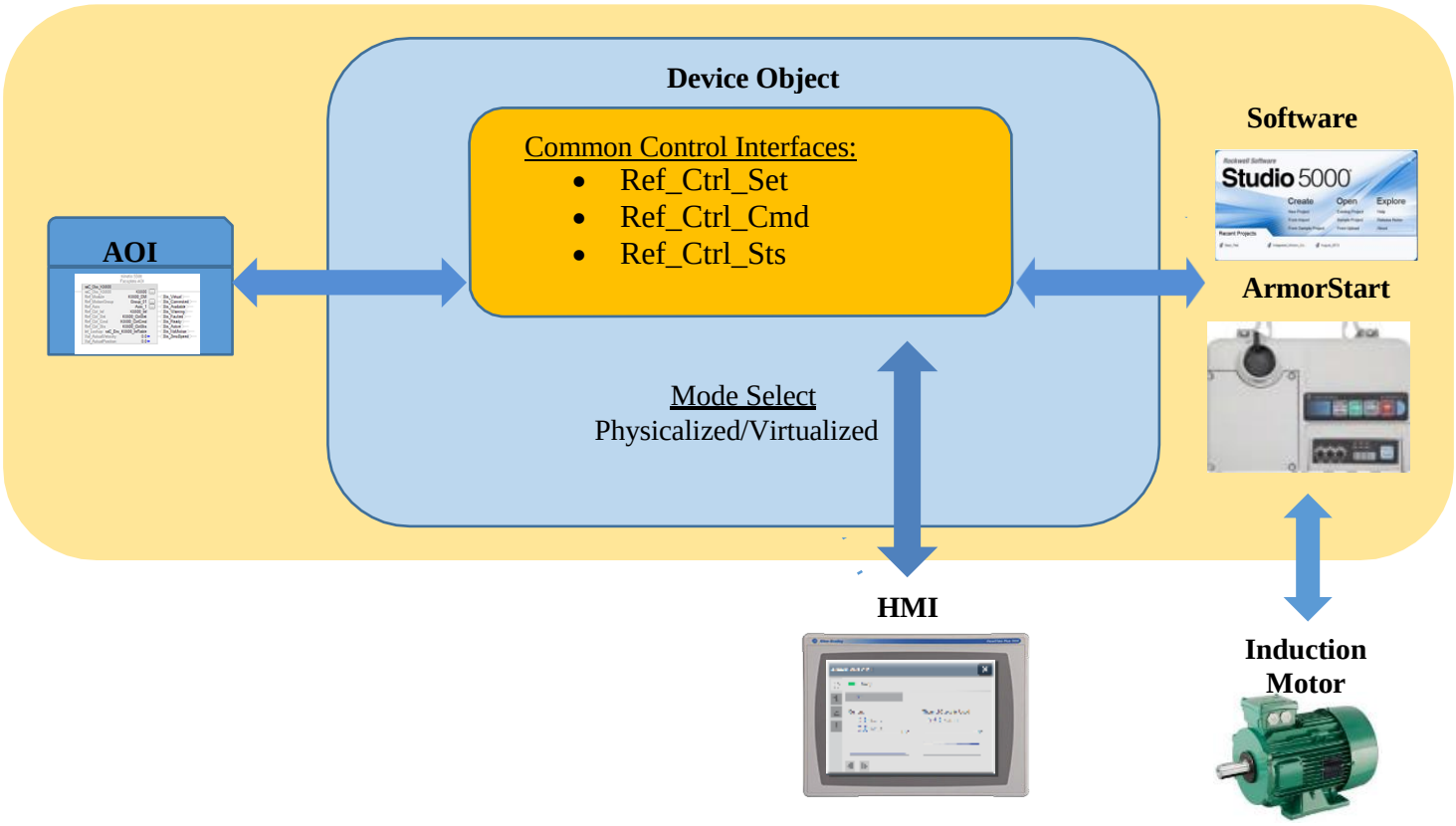
- PanelView 5500 with V4 or later firmware
- ControlLogix 5580 or ControlLogix 5570 controller with V31.011 or later firmware
- ArmorStart demo unit with AS 291E V1.013 or AS 281E V2.003 or later firmware

1.2 Functional Description

The ArmorStart 291E and 281E Preconfigured Device Objects:

- Collect, Process, and Deliver Data between Smart Devices and Application Logic
- Provide Device Status & Diagnostics Faceplates for Machine Startup, Commissioning, Operations, and Maintenance
- Include Common HMI Faceplate Components, Device States, and Control Interfaces providing Application Development and Operation Efficiency

All of these features deliver the user a tool that provides quick feedback, shortens recovery time, and simplifies implementation.



1.3 Footprint

Characteristic	Description	Value	Unit
Definition	Estimated memory required to store the object definition, including all dependents (including 1 Instance).	127	kB
Instance	Estimated memory required per object instantiated.	4	kB
Execution L7x	Estimated execution time / scan footprint evaluated in 1756-L7x PAC	110	µs

2. Device Object Architecture

2.1 Functional Requirements

2.1.1 Primary functions

- **Physical Device Operation**

  The following functions are applied when device object is selected as physical.

  Activate: Activate the device power structure. Device will follow the direction from control interface.

  Deactivate: Deactivate the device power structure by issuing Stop command. Reset active status.

  Jog: This function is possible from HMI faceplate only. When Jog command is 1, Activate device power structure. Once the command is 0, deactivate the device power structure by issuing stop command. Individual Jog forward and Jog reverse command are used to jog in either direction. Unlike other command bits, this command should not be unlatched by the device object.

  Fault Reset: Command to fault reset the device and also reset status bits in device object. Command can be initiated from control interface and also HMI interface.

- **Virtual Device Operation**

  Activate: Set status to reflect successful activate command, Device related signals like Logic command and Out Reference should not be altered.

  Deactivate: Reset the active status.

  Jog: This function is possible from HMI faceplate only. When Jog command is 1, set status to reflect successful jog command. Once the command is 0, reset the active status. Individual Jog forward and Jog reverse command are used to jog in either direction. Update the direction status based on jog forward and jog reverse.

  Fault Reset: Command to reset status bits in device object. Command can be initiated from control interface and also HMI interface.

2.1.2 Secondary functions

- **First Warning:** This function helps in capturing the first warning triggered in the device. Display the respective description in faceplate.
- **First Fault:** Capture the first fault from device. Display the respective description in faceplate.
- **Event log:** Log Warning and Fault the last 4 events in a log queue. The queue contains fault code, description and time stamp. Display the same in faceplate.
- **Status Interface:** Display device status

3. Data Types

The following Power Discrete Common Control Interface tags are the primary device program tags to read and write to when interfacing to power discrete devices. The value of using these tags in your specific application code is that you may use a number of different power discrete devices such as ArmorStart Starters, E300 Overload Relays, or SMC-50 Smart Motor Controllers without having to update your application device interface tags.

Note:

For further information and examples on how to interface the power device objects with your specific application code refer to the "How_To_Interface_with_Power_Device_Logix.mp4" video within the General Documents folder of the Power Device Library Download files.

The Power Device Library may be downloaded from the Product Compatibility and Download Center. Search for Power Device Library.

https://compatibility.rockwellautomation.com/Pages/home.aspx

3.1 raC_UDT_ItfAD_PwrDiscrete_Set

This is the Power Discrete Common Control Interface User-Defined Data Type for device settings. Its members provide application program access to allow or inhibit commands and settings from the device faceplate or other external sources. The table below shows member names, descriptions, and tag data types.

For example, to inhibit write commands from the device faceplate or other external sources write a 1 to the *ModuleName*_AOI_CtlrSet.InhibitCmd program tag from your application program. This would prevent a jog command from the device faceplate.

Member	Description	DataType
InhibitCmd	1 = Inhibit user Commands from external sources; 0 = Allow Control	BOOL
InhibitSet	1 = Inhibit user Settings from external sources; 0 = Allow	BOOL

3.2 raC_UDT_ItfAD_PwrDiscrete_Cmd

This is the Power Discrete Common Control Interface User-Defined Data Type for device commands. Its members provide application program access to common device commands.

Only write to these common command members to control the device. If you write directly to the device's output command tags directly unexpected device operation could occur.
For example, to start or activate the device write a 1 to the *ModuleName*_AOI_CtlrCmd.Activate tag. Do not write to the ModuleName:O.RunForward tag. Although, you can write to the uncommon command tags in the device's output tag if a specific common control interface tag does not exist.

The table below shows member names, descriptions, and tag data types.
All the commands are available whether operating the device physically or virtually. Virtual Operation allows you to test your application code without activating the device's physical outputs.

Member	Description	DataType
bCmd	Device Interface – Power Discrete Commands	INT
Physical	1 = Operate as a physical device	BOOL
Virtual	1 = Operate as a virtual device	BOOL
ResetWarn	1 = Reset Warning Status. Clears FirstWarning Capture Status	BOOL
ResetFault	1 = Reset Fault Status. Clears FirstFault Capture status.	BOOL
Activate	1 = Activate Output Power Structure. Commands the device to Run	BOOL
Deactivate	1 = DeActivate Output Power Structure. Commands the device to Stop	BOOL
CmdDir	Commanded Direction; 0=Forward, 1=Reverse	BOOL
Jog	Jog Command	BOOL
Fast	Fast speed of a 2 speed device	BOOL
Slow	Slow speed of a 2 speed device	BOOL

3.3 raC_UDT_ItfAD_PwrDiscrete_Sts

This is the Power Discrete Common Control Interface User-Defined Data Type for device status. Its members provide application program access to device states, status, and diagnostic data. The table below shows member names, descriptions, and tag data types.

Input	Description	DataType
eState	Enumerated state value of the device object. 1=Initializing 2=Disconnected 3=Disconnecting 4=Connecting 5=Idle 6=Configuring 7=Available	DINT
FirstWarning	Capture the First Alarm Bit to trigger. Display the respective Description and Time Stamp on Faceplate. Log the same in Event Queue.	Rac_UDT_Event
FirstFault	Capture the Fault Code of the device. Display the respective code, description and timestamp on faceplate. Log the same in Event Queue.	Rac_UDT_Event
eCmdFail	Enumerated command failure code 0 = Interface Initialization failure code 1 = Operate as Physical Device failure code. 2 = Operate as Virtual Device failure code	DINT
bSts	Status (Bit Overlays)	INT
Physical	1 = Operating as a physical device	BOOL
Virtual	1 = Operating as a virtual device	BOOL
Connected	1 = Showing Device connection status connected	BOOL
Available	1 = Device Available	BOOL
Warning	If any warning alarm is activated then this bit is set to 1	BOOL
Faulted	If any Fault is activated then this bit is set to 1	BOOL

Input	Description	DataType
Ready	1 = Device is active (Power Structure Active)	BOOL
Active	1 = Device is active (Power Structure Active)	BOOL
CmdDir	Command direction; 1=Reverse, 0=Forward	BOOL
ActDir	Actual direction; 1=Reverse, 0=Forward	BOOL
CmdSpd	1 = Motor is Commanded to run fast 0 = slow	BOOL
Fast	Fast speed selected (2-Speed device)	BOOL
Slow	Slow speed selected (2-Speed device)	BOOL

3.4 raC_UDT_Event

An array of size 4 is to be used to log the FirstWarning and FirstFault capture. The data should be FIFO order. The same should be displayed on the Faceplate.

Member	Description	DataType
Type	1 = Status 2 = Warning 3 = Fault 4 ...n = User	DINT
ID	User definable event ID	DINT
Category	User definable category (Electrical, Mechanical, Materials, Utility, etc.)	DINT
Action	User definable event action code	DINT
Value	User definable event value or fault code	DINT
Message	Event message text	STRING
EventTime_L	Timestamp	LINT
EventTime_D	Timestamp (Y,M,D,h,m,s,us)	DINT[7]

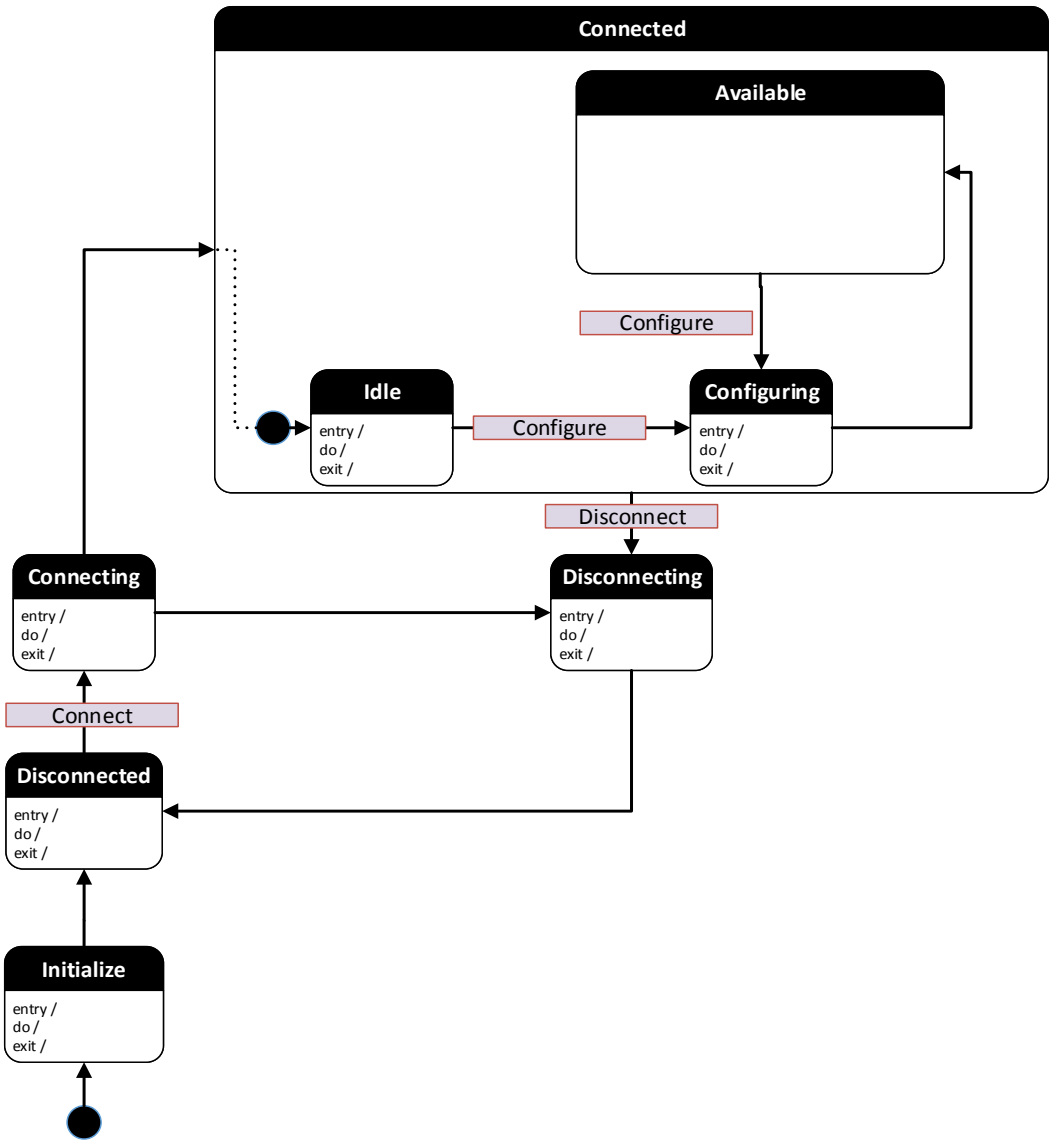
3.5 raC_UDT_LookupMember_STR0082

Member	Description	DataType
Code	Stores the value of device fault code.	DINT
Desc	Stores the Messages related to fault code.	STRING

3.6 State Model

The following section will discuss the state model for Device Object. The figure below shows the core logic states.

By default, each state is active for a minimum of 256us to allow for evaluation of state outside of the ADO instance in the user program.



3.7 State Definitions

State	Enumeration	Type	State Command
Initializing	1	Acting	(Initial)
Disconnected	2	Wait	
Disconnecting	3	Acting	Disconnect
Connecting	4	Acting	Connect
Idle	5	Wait	
Configuring	6	Acting	Configure
Available	7	Dual	

3.8 State Actions

State	Action / Function
Initializing	Initialize object and interface (status, command, etc) data structures Set ADO to operate as Physical Device specific initialization if required
Disconnected	➔ Connect
Disconnecting	
Connecting	Physical - Verify module connection to PAC Virtual – N/A
Idle	➔ Configure
Configuring	Verify all module configuration has been complete.
Available	Device specific

Note:
For further information for configuring Add-On Instructions for ArmorStart Power Discrete Device Objects in Logix Designer refer to “How_To_Import_and_Configure_AS_Starter_Objects_in_LogixDesigner.mp4” video within the PowerDeviceObjects folder of the Power Device Library Download files.

The Power Device Library may be downloaded from the Product Compatibility and Download Center.
Search for Power Device Library.
https://compatibility.rockwellautomation.com/Pages/home.aspx

4. User Interface

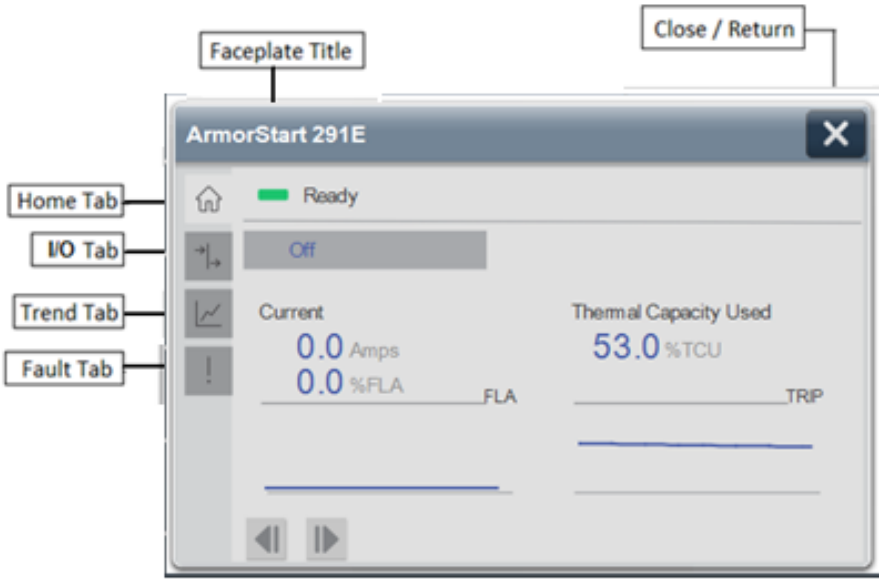
The faceplate files allow you to quickly load, configure and use preconfigured status and diagnostic displays available for View Designer, FactoryTalk View ME Edition and FactoryTalk View SE Edition.

In this document, the following faceplate images (or snapshots) are for View Designer faceplates and are similar to FactoryTalk View ME and SE Edition faceplates. All HMI platform faceplates may be downloaded from the Product Compatibility and Download Center. Search for Power Device Library.
https://compatibility.rockwellautomation.com/Pages/home.aspx

Note:
For further information on faceplate configuration and operation refer to the "How_To_Import_and_Configure_AS_Starter_Objects" and Operational_Overview_of_AS_Starter_Faceplates" videos within the ArmorStart folder of the Power Device Library Download files.

The Power Device Library may be downloaded from the Product Compatibility and Download Center. Search for Power Device Library.
https://compatibility.rockwellautomation.com/Pages/home.aspx

4.1 Faceplate Navigation



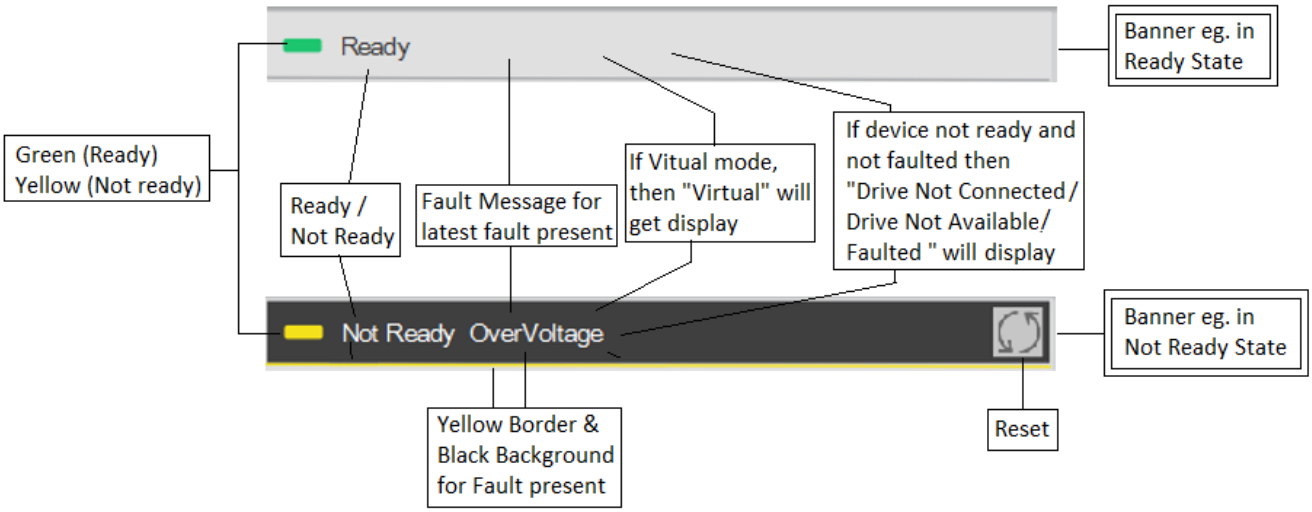
Tab descriptions:

- The **Home** tab provides a device status summary and basic control functions
- The **I/O** or Input/output tab displays the on/off status of the device's I/O
- The **Trend** tab displays real-time values of position and velocity for the device in user units
- The **Fault** tab displays a running history of the last (4) faults and alarms with descriptions

4.2 Common Status

A banner will be displayed at the top of each screen to provide the following information of the device:

- Ready or Not Ready
- Faulted (device will show Not Ready and fault message).
- Virtualized
- Communications loss.

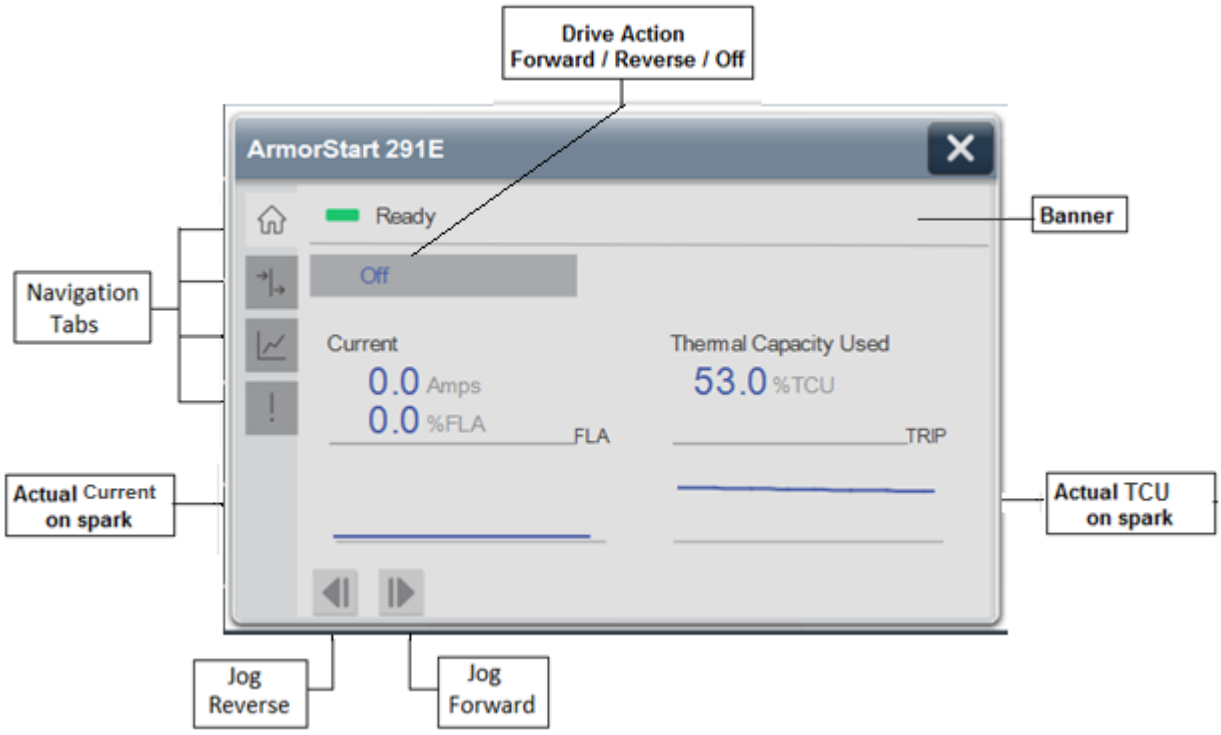

Ready
Banner eg. in Ready State
Green (Ready)
Yellow (Not ready)
Ready / Not Ready
Fault Message for latest fault present
If Vitual mode, then "Virtual" will get display
If device not ready and not faulted then "Drive Not Connected/ Drive Not Available/ Faulted " will display
Not Ready OverVoltage
Banner eg. in Not Ready State
Yellow Border & Black Background for Fault present
Reset

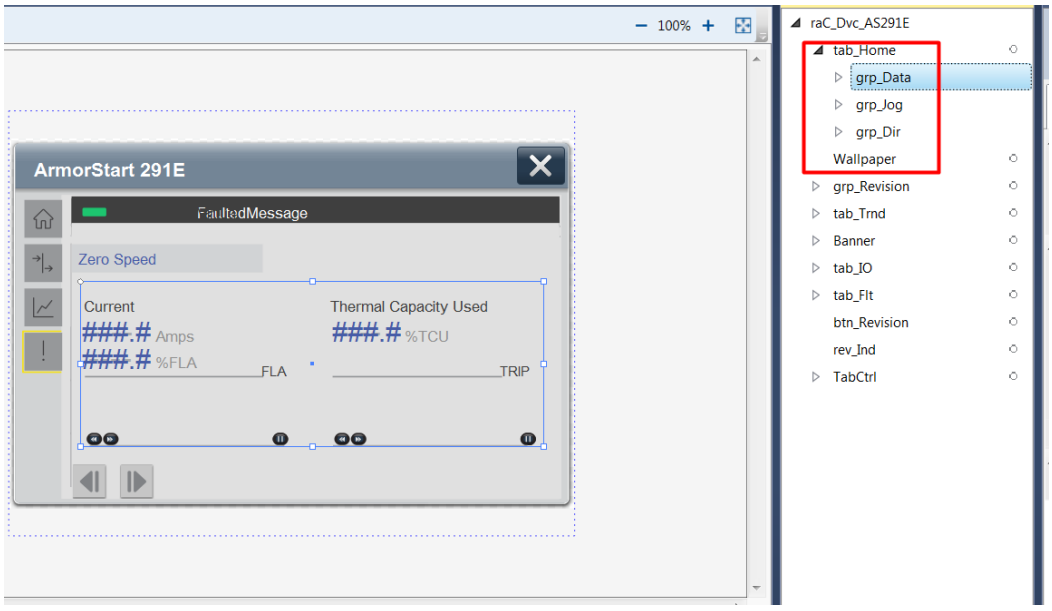
4.3 Home Screen

The Home screen is visible when the Home tab button is selected in the tab control object on the left side of the screen.

The Home screen is the main screen for the faceplate. It contains Numeric display objects, two small trends called sparklines and a jog control object. These objects are created with sets of elements grouped into 3 sub-groups: ***grp_Data, grp_Dir, grp_Jog***.

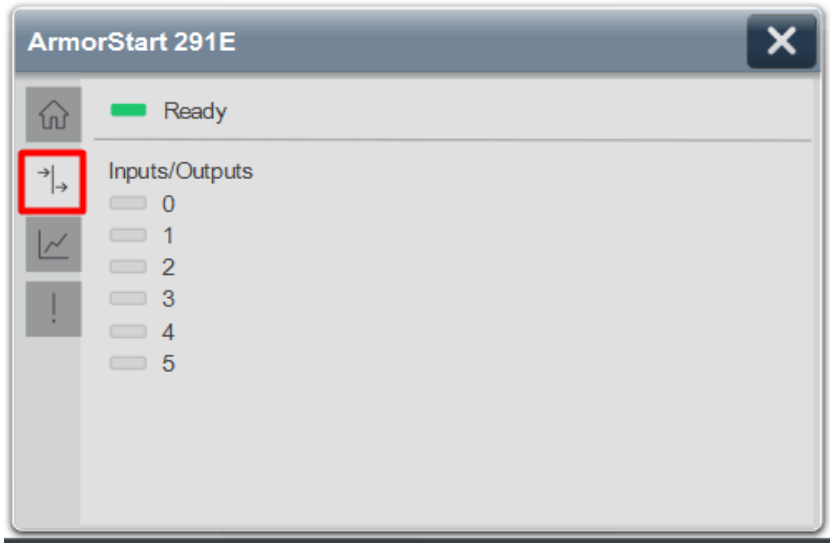
On the top left is a speed indicator that is a multi-state indicator and changes text based on the device state. Other text for state changes include, “Forward”, “Reverse”, “Zero Speed”, and “Off”. The Current, %FLA and %TCU are large blue numeric display that are read-only. Below the numeric display is a Spark line to display %FLA and another spark line is to display %TCU.



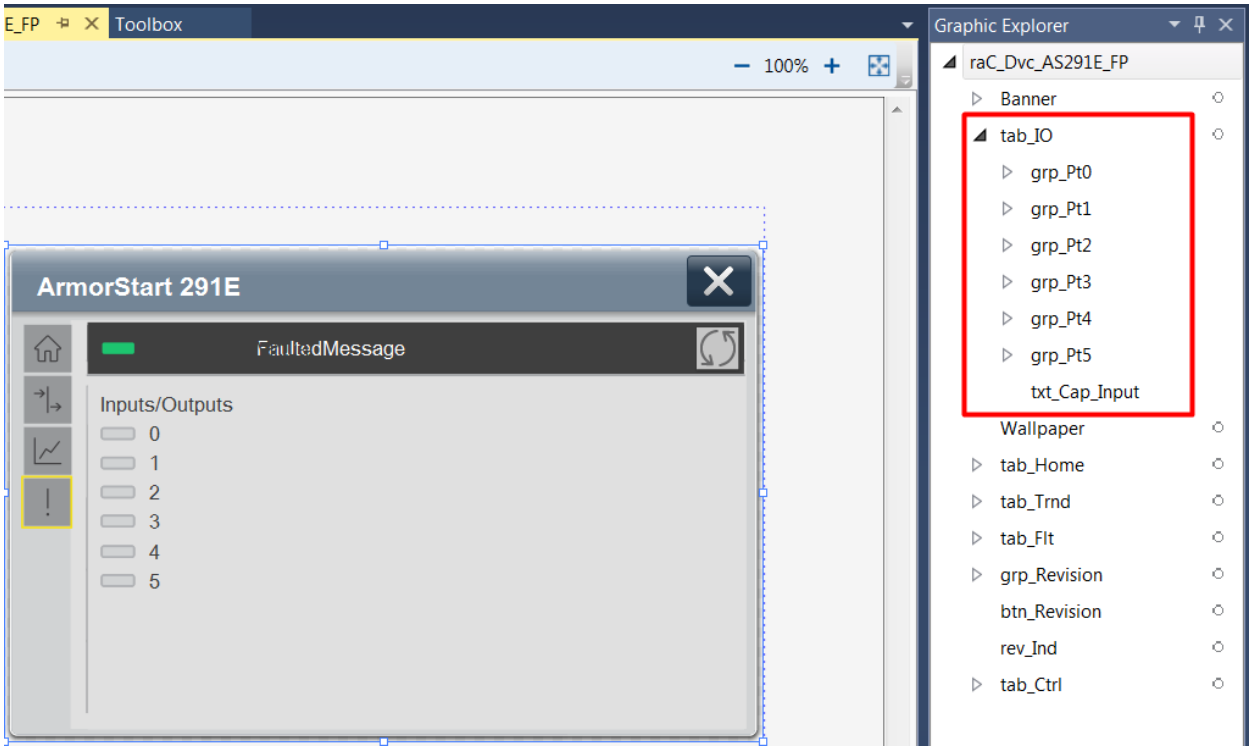


4.4 I/O Screen

The I/O tab displays the on/off status of the device's I/O. LED shows no color when they are in the OFF position and shows blue when they are in the ON position.

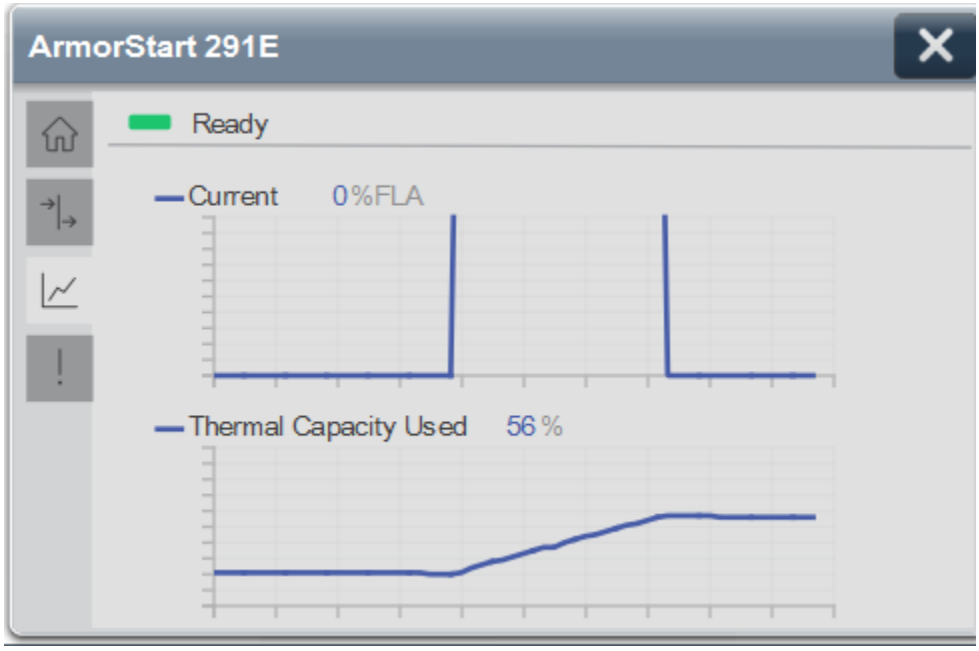


The IO screen displays contains multiple Status indicator LED's for Input and Output.



4.5 Trend Screen

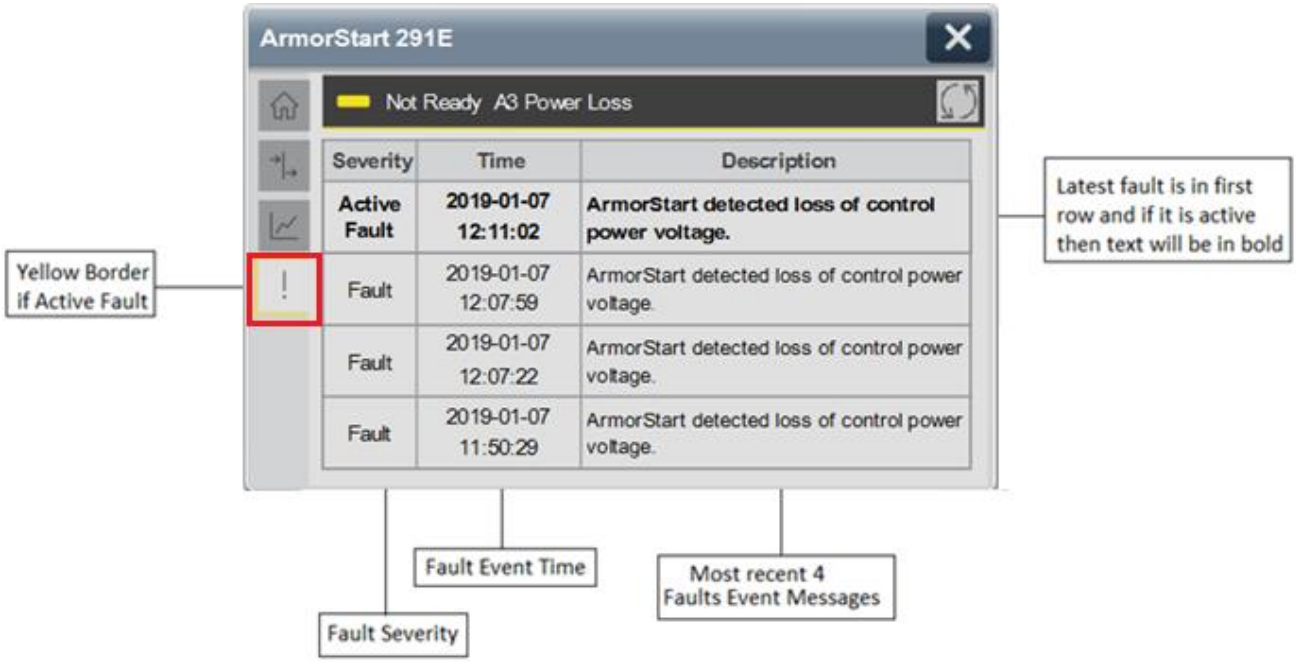
Trends display values over time, often used to compare similar or related values and to allow operators to predict future states to make control action decisions.



The trend screen displays two trends for current (FLA%) and Thermal capacity used. It contains numeric displays for these two values, labels and engineering units. These objects are grouped into 3 sub-groups: ***grp_Banner, grp_CurTrnd*** and ***grp_TCUTrnd***.

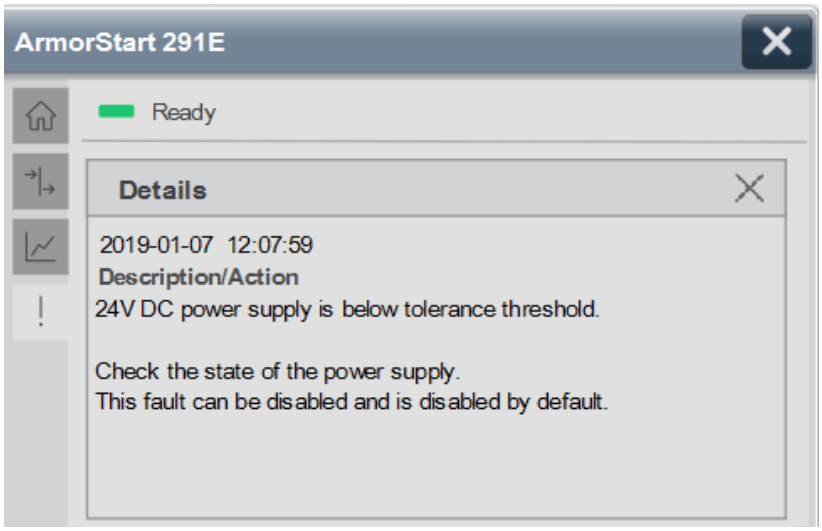
4.6 Fault Warning Screen

The Fault Warning screen displays information for up to four faults for the device. The fault table displays the Severity level (Fault, Warning or Active Fault), time (and date) and a description of the fault.
Note, only row 1 will display the “Active Fault” in the severity column if there is a current active fault, else it will display the last fault. Rows 2-4 only display past faults and warnings, not an active fault.



4.6.1 Details Screen

The Details Screen provides a more detailed description and possible action steps to remedy condition.


ArmorStart 291E
Ready
Details
2019-01-07 12:07:59
Description/Action
24V DC power supply is below tolerance threshold.
Check the state of the power supply.
This fault can be disabled and is disabled by default.

5. *Appendix*

For More Configuration and Operational Information

Refer to How to & Operational Videos within the PowerDeviceObjects folder of the Power Device Library download files.

The Power Device Library may be downloaded from the Product Compatibility and Download Center. Search for Power Device Library.
https://compatibility.rockwellautomation.com/Pages/home.aspx

To Provide Feedback or Obtain Additional Information

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